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REPORT OF THE OPERATIONS OF

THE OIL AND GAS CONSERVATION BOARD

1968

OIL AND GAS CONSERVATION BOARD
603 SIXTH AVENUE SOUTH WEST • CALGARY 1, ALBERTA

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THE OIL AND GAS CONSERVATION BOARD

REPORT OF THE OPERATIONS OF

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P R E F A C E

This report is the sixth edition of an annual report on the operations of the Oil and Gas Conservation Board. It is introduced with a brief discussion of the general activities of the oil and gas industry in 1968, emphasis being placed on those related to conservation. Following this is a summary of the constitution, responsibilities and functions of the Board; a discussion of its organization and staff; and a general summary of important statutory changes affecting the Board. The main section of the report deals with the responsibilities, organization and activities of the several departments of the Board and discusses the role of each in the discharge of the overall responsibilities of the Board. Finally, there is a statement of Board expenditures and revenues, comparing them with previous years and with indices of industry and Board activity.

P R E F A C E

I THE ALBERTA OIL AND GAS INDUSTRY IN 1968

Exploration

The Tempo of exploratory activity showed marked improvement in total footage and number of wells drilled during the year. The development of new crude oil reserves continued to be centred in the Rainbow and Zama areas while significant gas discoveries were made in the Whiskey Creek, Berland River and Chestermere areas. Early follow-up drilling of a 1967 discovery near Strachan, south-west of Red Deer, confirmed a major new oil and gas play in this area.

Exploratory wells drilled increased exceptionally by some 36 per cent during 1968 to 1,025 wells as compared to 756 wells during the previous year. Total exploratory footage drilled in 1968 was 4,998,595, an increase of 32 per cent over the 3,797,295 feet drilled in 1967. Accordingly, the average depth of exploratory wells dropped from 5,023 feet in 1967 to 4,877 feet in 1968. A slightly reduced degree of success was achieved in 1968, with a proportion of successful exploratory wells of 33 per cent compared to 36 per cent in 1967.

Development

The total number of development wells drilled rose from 840 wells in 1967 to 881 wells during 1968, an increase of some 5 per cent. Successful oil wells drilled declined from 481 in 1967 to 366 in 1968, whereas the number of successful gas wells was substantially higher: 235 as compared to 163.

Development footage drilled declined by some 3 per cent during 1968 to 4,015,513 feet as compared to 4,130,704 feet drilled in 1967. Thus, the average well depth dropped from 4,918 feet in 1967 to 4,558 feet in 1968.

During 1968 development drilling for oil was concentrated mainly in the Zama-Rainbow-Virgo areas, Chauvin South, Hamilton Lake and Wainwright fields. Most of the development drilling for gas occurred in the Alderson, Medicine Hat, Crossfield East, Tweedie and Kaybob South areas.

Reserves

Initial recoverable crude oil reserves showed a substantial increase of 754 million barrels during 1968, to reach a total of 10,340 million barrels by the end of the year. The increase to remaining recoverable reserves was 503 million barrels, after deduction of 251 million barrels produced during 1968. The remaining recoverable reserves of crude oil were 7,632 million barrels as at December 31, 1968 as compared to 7,129 million barrels at the end of 1967.

A major portion of the increase in initial reserves was attributable to reserve appreciation in a number of previously discovered pools, including the Mitsue Gilwood A, Swan Hills Beaverhill Lake C, Joarcam Viking, Joffre D-2, Goose River Beaverhill Lake and certain Rainbow Keg River pools. New discoveries and appreciation in other areas accounted for the remaining increase.

Initial marketable gas reserves increased by about 4.8 trillion cubic feet, reaching a total of 51.8 trillion cubic feet as at December 31, 1968. Production of marketable gas in 1968 was some 1.1 trillion cubic feet; hence, remaining marketable gas reserves increased by some 3.7 trillion cubic feet to 43.4 trillion cubic feet as at December 31, 1968. This compares to 39.7 trillion cubic feet at December 31, 1967. Most of the increase in initial reserves resulted primarily from appreciation of previously discovered reserves, particularly in the Kaybob South Beaverhill Lake A, Waterton Rundle Wabamun and Quirk Creek Rundle A pools.

Remaining reserves of propane at year end 1968 were some 591 million barrels, an increase of 184 million barrels 1968 over 1967, while butane remaining reserves increased by some 106 million barrels to a level of 379 million barrels over the same period. Pentanes plus remaining reserves increased by some 259 million barrels in 1968 to a level of 935 million barrels at December 31, 1968. Thus, total remaining reserves of natural gas liquids increased by some 548 million barrels to 1,904 million barrels as at the end of 1968. Most of the increase to reserves can be attributed to substantial increases in gas reserves recognized in the Kaybob South and Waterton areas.

Remaining reserves of sulphur increased to some 140 million long tons, a rise of 23 million long tons over the

1967 level. These values do not include the sulphur expected to be recovered by the processing of oil sands.

Crude Oil Productive Capacity

Following the practice adopted in 1966, the Board has published an assessment of the Province's crude oil productive capacity at the end of 1968 in its Annual Reserves Report, OGCB 69-18*. In each of the four categories to which the Board's estimates pertain, a net increase occurred in crude oil productive capacity during 1968. The totals and increases to the respective categories at the year end, which are mainly attributable to developments in the Rainbow-Zama areas and additional investment in field and processing facilities, are summarized below.

(1) Maximum Efficient Reservoir Capacity: some 2.4 million barrels per day, representing an increase of some 340,000 barrels per day over the 1967 figure.

(2) Developed Wellhead Capacity: some 1.57 million barrels per day, an increase of 65,000 barrels per day.

(3) Developed Capacity Adjusted for Field and Processing Facility Limitations: some 1,068,000 barrels per day, an increase of 114,000 barrels per day.

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* Reserves of Crude Oil, Gas, Natural Gas Liquids and Sulphur, Province of Alberta, December 31, 1968.

(4) Developed Capacity Adjusted for Pipe Line System Limitations: some 890,000 barrels per day, an increase of 29,000 barrels per day.

Production and Markets

In 1968 average daily production of crude oil rose substantially by 69,000 barrels to 701,000 barrels, an increase of some 11 per cent over 1967. In the first full year of operation, the Great Canadian Oil Sands plant production of crude oil averaged some 16,000 barrels per day. Pentanes plus production recorded an increase of some 7 per cent to total 87,000 barrels per day in 1968, as compared to 81,000 barrels per day in 1967.

Domestic demand for Alberta oil, which comprises conventional and synthetic crude oil and pentanes plus, in 1968 amounted to 419,000 barrels per day, an increase of some 9 per cent over the 1967 level of 383,000 barrels per day. Alberta's share of the total requirements for Canadian oil west of the Ottawa Valley increased from 61 per cent in 1967 to 64 per cent in 1968. Demand for Alberta oil within Alberta increased from an average of 96,000 barrels per day in 1967 to 98,000 barrels per day in 1968. Alberta exported to the United States some 369,000 barrels per day of oil during 1968, an increase of 39,000 barrels per day or nearly 12 per cent over the 1967 average.

Gross production of natural gas, net of amount returned to formation, increased by 186 billion cubic feet during 1968 to reach a total of 1,429 billion cubic feet, a rise of 15 per cent. Alberta marketed gas production was 1,088 billion cubic feet as compared to 960 billion cubic feet in 1967, an increase of over 13 per cent. The major portion of the marketed increase was accounted for by the higher exports to the United States, which expanded by some 21 per cent 1968 over 1967. Canadian markets for Alberta gas increased from 526 billion cubic feet in 1967 to 566 billion cubic feet in 1968, an increase of some 8 per cent. The amount consumed within Alberta rose from 199 billion cubic feet in 1967 to 206 billion cubic feet during 1968.

Substantial growth was recorded in the production of propane and butane in 1968. Production of propane rose by over 14 per cent from 35,000 barrels per day in 1967 to 40,000 barrels per day in 1968; production of butane averaged 26,000 barrels per day, as compared to 23,000 barrels per day in 1967, a 13 per cent increase. These increases are a reflection partly of the rise in natural gas production but also of the more extensive processing and recovery due to new plants and expansion of existing gas plants. Export markets absorbed the greater portion of the increase, while domestic markets accounted for the balance.

Similarly to LPG's, production of sulphur increased

significantly in 1968, rising by 874,000 long tons to 2,990,000 long tons as compared to 2,116,000 long tons in 1967, an increase of 41 per cent. The additional production was associated with synthetic oil production from the Athabasca Oil Sands by the Great Canadian Oil Sands plant, the completions of new gas processing plants at Bigstone, Caroline, Crossfield East, Rainbow and Kaybob South and the installation of new or enlarged extraction facilities at several existing plants. In contrast, no such growth was recorded in demand. Shipments of sulphur to Canadian and U.S. markets increased only marginally from the 1967 level of 1,284,000 long tons to 1,322,000 long tons in 1968. Offshore shipments went up by some 4 per cent from 851,000 long tons in 1967 to 888,000 long tons in 1968. In total, production of sulphur exceeded deliveries by 780,000 long tons. Consequently inventory levels increased substantially in 1968, a reversal of the trend during immediate preceding years.

Conservation Activity

Developments in Oil

On May 1, 1968 the penultimate step in the implementation of the new proration plan was taken; the minimum allowance for all pools became the operating economic allowance of the former plan. This allowance was applied as a base allowable floor and confined to producing wells. However, some surplus wells in blocks and projects were permitted to continue receiving the minimum allowance until the end of the transition period.

About 30 new enhanced recovery schemes were considered during 1968. The most noteworthy projects were two integrated schemes in the Rainbow Field, involving vertical miscible displacement. Integrated schemes are designed to permit sequential miscible flooding of pools, giving optimum use of the limited available gas supply. The Board approved new waterflood schemes for a number of pools, and reviewed with the owners the pressure and production behaviour of some 165 pools in the Rainbow and Zama areas where the pressures have decreased rapidly, suggesting the possible early need for some form of an enhanced recovery scheme. Suitable follow-up action was taken.

Significant developments in the oil sands included the hearing of an application by Atlantic Richfield Company, Cities Service Athabasca, Inc., Imperial Oil Limited and Royalite Oil Company, Limited for approval of a commercial plant producing 50,000 barrels per day of synthetic crude oil and 30,000 barrels per day of specialty products. The application was reported upon in OGCB Report 68-C* and was approved subject to the applicant satisfying the Board as to certain outstanding matters at a hearing to be called in 1969. The Great Canadian Oil Sands plant completed its first full year of operation but continuing production difficulties precluded full utilization of design capacity.

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* Report on an Application of Atlantic Richfield Company, Cities Service Athabasca, Inc., Imperial Oil Limited and Royalite Oil Company, Limited under Part IV A of The Oil and Gas Conservation Act.

Developments in Gas and Propane

During 1968 the Board heard applications by Trans-Canada Pipe Lines Limited and Alberta and Southern Gas Company Limited for approval to remove additional quantities of gas from the Province. The Board reported on the Trans-Canada application in OGCB Report 68-A* published in November, 1968 and, with the approval of the Lieutenant Governor in Council, issued a new permit to Trans-Canada authorizing the removal of an additional 2.1 trillion cubic feet of gas from the Province over a 25 year period ending October 31, 1993. The report on the application by Alberta and Southern was being prepared at the year end. The Board also considered an application from Dome Petroleum for removal of additional amounts of propane from the Province and following issuance of OGCB Report 68-B** approved by Permit No. 68-1 the removal of an additional 89 million barrels of propane from the Province over a 25 year period ending October 31, 1994.

Gas conservation facilities were installed in the Aerial, Ante Creek, Lone Pine Creek and Rainbow fields and extended in several other fields including the Simonette, Sturgeon Lake South and Sundre fields.

New gas processing plants were approved for Brazeau, Ferrier, Judy Creek, Kaybob-Fox Creek, Marten Hills, Simonette

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* Report on an Application of Trans-Canada Pipe Lines Limited under The Gas Resources Preservation Act, 1956.

** Report on the Application for a Permit Authorizing the Removal of Propane from the Province of Dome Petroleum Limited and Pan American Canada Oil Company, Ltd. under The Gas Resources Preservation Act, 1956.

and Tweedie. In addition the Board approved an application by Alberta Natural Gas Company to build a plant near Cochrane to reprocess for liquid recovery the gas carried by the foothills division of Alberta Gas Trunk Line.

Government Revenue

Total Government revenue from oil and gas mineral rights increased from $234 million in 1967 to $250 million in 1968. The 1968 total reflects rental payments of $55 million, an increase of only $1 million from 1967; royalty payments of $101 million, an increase of $8 million and revenue from Crown Reserve sales of $93 million, an increase of $5 million.

Industry Revenue

Total revenue to the oil and gas industry from sales during 1968 totalled $1,026 million, an increase of some 13 per cent over the 1967 level of $911 million. Sales of crude oil and pentanes plus continued to yield the largest revenue and rose by some 12 per cent from $663 million in 1967 to $745 million in 1968. In proportionate terms, this increase is somewhat higher than the increase in the volume of production and indicates a minor increase in the average price of crude oil and equivalent during 1968. Average price increases are also evident in sulphur, revenue from which increased from $65 million in 1967 to $76 million in 1968, or by nearly 18 per cent, as compared to an increase of some 4 per cent in the volume of sales. The total revenue from sales of gas, propane

and butane rose by some 12 per cent, with gas revenue amounting to $171 million, a 13 per cent rise, propane totalling $22 million, 5 per cent more than in 1967, and butane amounting to $13 million, a 10 per cent increase. For propane and butane the increase is slightly less than the increase in volume of sales and indicates minor reductions in the average price for these products during 1968.

II . RESPONSIBILITIES AND FUNCTIONS OF THE BOARD

The Board is established by The Oil and Gas Conservation Act for the purpose of administering that Act. It is also charged with the administration of The Gas Resources Preservation Act, 1956, and The Turner Valley Unit Operations Act. Additionally, it may be called upon to supply information and advice to the Department of Mines and Minerals, particularly in connection with applications for permits under The Pipe Line Act, 1958. Finally, the Board, like the Public Utilities Board, may refer applications that touch on matters in part within the purview of each of the Boards to the Gas Utilities Board, of which the Chairman of the Oil and Gas Conservation Board is a member and to which the Board gives technical and other assistance in connection with applications referred by it.

The purposes of The Oil and Gas Conservation Act are to effect the conservation and prevent the waste of the oil and gas resources of the Province, to secure the observance of safe and efficient field practices, and to afford each owner of oil or gas the opportunity of obtaining his share of the production of any pool. The Board must see that, in the light of sound engineering and economic principles, oil field operations are so conducted that wells are properly located, spaced, drilled, equipped and produced so that the recovery of oil or gas from a pool is not lessened and reservoir energy is not improperly dissipated, that enhanced recovery techniques are used where suitable, that waste of gas is minimized, that proper storage

facilities are used, and that oil or gas is not produced in excess of demand or of storage and transportation facilities.

To carry out these functions the Board employs the appropriate personnel including engineers, geologists and others. It maintains a head office in Calgary and area offices serving major oil and gas regions. The Board issues regulations and orders pertaining to drilling and producing operations; considers applications by operators; has its staff conduct inspections and make studies; and collects, summarizes and publishes various data.

Under The Oil and Gas Conservation Act, the Board also is charged with the examination of schemes, either of an experimental or commercial character, for obtaining production from oil sands. The Board also, under Part VII of the Act, assesses and taxes oil and gas properties to obtain a revenue to cover a portion of its expenses under the Act. The carrying out of its duties and responsibilities under this Act and other Acts requires the Board to conduct investigations, hold hearings and prepare reports.

The Turner Valley Unit Operations Act empowers the Board, upon application, to order a part of the Turner Valley Rundle Pool to be operated as a unit. Under this Act, four oil productive and one gas productive units have been established encompassing substantially all of the Turner Valley Field.

The purpose of The Gas Resources Preservation Act, 1956, is to provide for the effective utilization of the gas resources of the Province, having regard to the present and future needs of persons within the Province. For this purpose, the Board must from time to time determine the volumes of established reserves of gas and propane in the Province and the trends in growth and discovery of gas and propane reserves and the present and future needs for gas and propane within the Province. Applications for permits for the removal of gas or propane from the Province are considered in the light of such determinations and may be granted if it is in the public interest to do so.

III ORGANIZATION AND STAFF

The Board consists of three Board Members, appointed for a five year period by the Lieutenant Governor in Council, a Chairman, Deputy Chairman and Board Member. The term of appointment may be extended at the pleasure of the Lieutenant Governor in Council.

The Board's senior advisers are its Chief Engineer and Solicitor. They provide technical and legal advice directly to the Board and, when appointed for the purpose, function as acting Board members. An Applications Advisory Group under the Chairmanship of the Chief Engineer and including the Board Solicitor and the Managers of the Gas, Oil and Development Departments advises the Board on routine applications. Also the Managers of these three departments serve with other senior staff as examiners at hearings.

The organization chart as presented indicates the overall organization of the Board showing its various departments. The departments vary in size, ranging from 68 employees in the Development Department to five in the Personnel Department. Each Department Head is responsible to the Board for carrying out the functions assigned to his department as summarized in Section V of this report.

In 1968 the Board maintained five area offices staffed by engineers and technicians whose basic responsibility is to inspect drilling and producing procedures in oil and gas fields.

Area offices are located at Red Deer, Black Diamond, Medicine Hat, Drayton Valley and Edmonton. The Engineer or Area Supervisor in charge of each area office is responsible to the Senior Development Engineer who, in turn, is responsible to the Manager of the Development Department.

In general, the Board's Development Department is responsible for the drilling and production practices of the industry, and the Oil and the Gas Departments are responsible for ensuring maximum conservation from oil and gas pools as discovered and developed. The Gas Department is additionally responsible for assisting the Board in controlling the volume of gas and propane removed from the Province. The Geology Department, the Data Processing Department and the Chemical Laboratory provide technical assistance directly to the Board and to the three main engineering departments. The Economics Department and the Production Accounting Division of the Accounting Department provide economic and statistical data and assistance. The Economics Department also administers the crude oil proration plan with the assistance of the Oil Department. The Office Services and the Personnel Departments, and the Financial Accounting Division perform services for the Board organization as a whole.

The Board had an approved staff complement of 280 employees at the year end. This represents an increase of eight during the year. Of the total staff, 227 are located in Calgary, 48 in the Board's area offices and five in the

Chemical Laboratory in Edmonton. The actual number of employees at December 31, 1968 was 268.

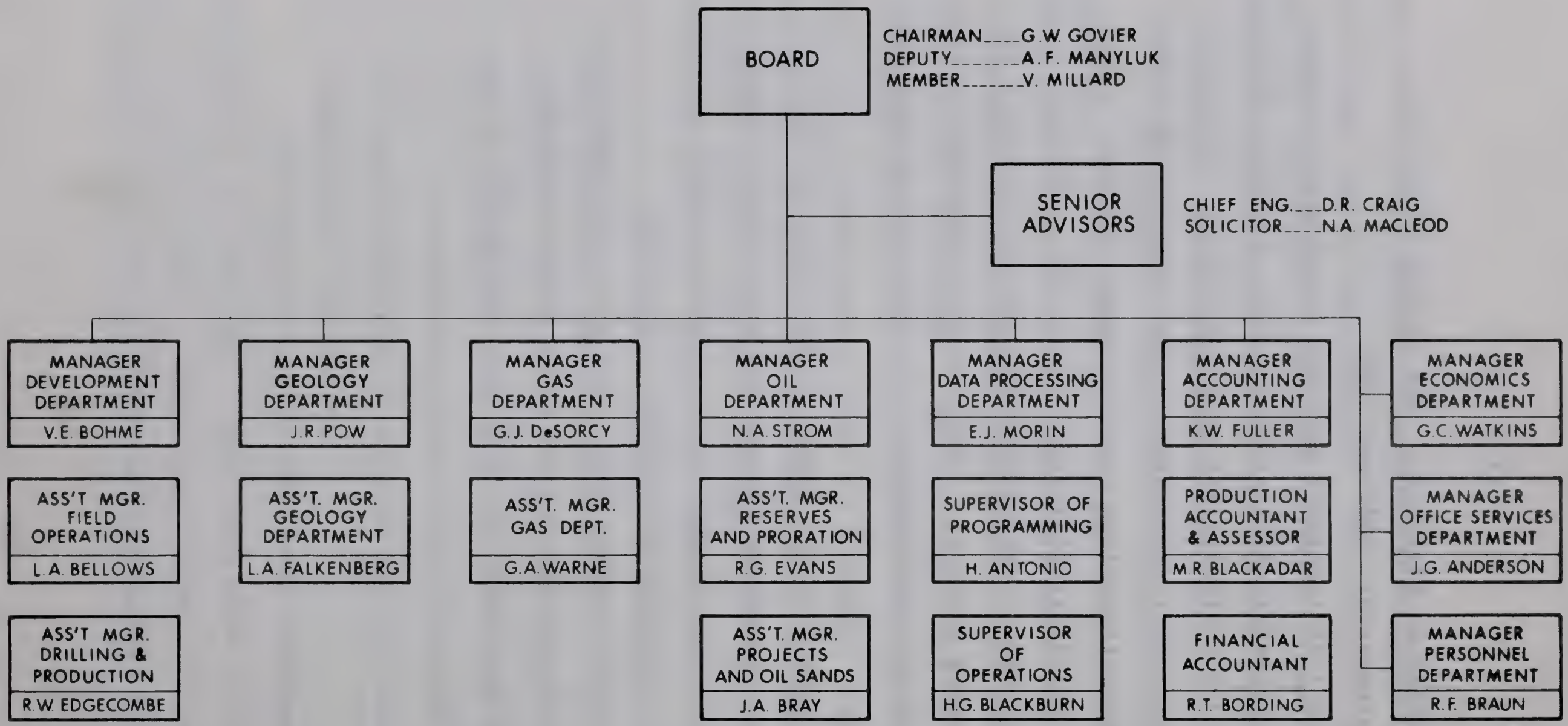
During 1968 the Board held two on-premises courses to further its employee development program, the Field Training Course and the Job Instructional Training Course. The Board also provided financial assistance to approximately 80 employees who attended off-premises courses during the year. Two employees were on educational leave to attend university. In addition, the Technical Proficiency Program was continued this year with expanding success. The program is designed to maintain and improve the proficiency of technical and professional staff employees.

As a result of the recent installation of the I.B.M. System 360, four in-company courses and eight other courses at the I.B.M. Educational Center were presented to Board employees to expand their knowledge of computer technology.

The staff turnover during the past year amounted to 55 employees or 21 per cent of the total Board complement. This compares with a turnover of 21 per cent in 1967 and 23 per cent in 1966.

OIL AND GAS CONSERVATION BOARD

BOARD ORGANIZATION



IV LEGISLATIVE CHANGES

Statutes

The Oil and Gas Conservation Act was amended by chapter 74 of the Statutes of Alberta, 1968. Major amendments were made concerning two matters, oil sands development and proration of oil in pools subject to an integrated scheme for enhanced recovery. Additionally a few minor amendments were made for correction or clarification.

During the 1968 session, the Government tabled in the Legislative Assembly a policy statement modifying its oil sands development policy which had been announced in 1962. In light of the policy modifications, the Act was amended by adding definitions of "crude bitumen", "oil sands" and "synthetic crude oil", by authorizing the Board to decide when any mixture is crude bitumen and to designate oil sands deposits, by substantially rewriting Part VIA under which schemes for obtaining production from oil sands are approved, by expanding the provisions regarding records and reports to cover oil sands operations, and by a number of minor consequential amendments throughout the Act.

A new subsection was added to section 36 of the Act in which proration of production to market demand is authorized. Under it where two or more pools in a field or area are subject to an integrated scheme for enchanced recovery (as, for example, where a number of pools will sequentially be subjected to

injection of a fluid from a limited source and produced), the Board in certain circumstances, may allocate in each proration period an aggregate amount of production to be taken from the pools.

Regulations

At the first of the year, 1968, the Oil and Gas Conservation Regulations, in which the previous regulations under The Oil and Gas Conservation Act were revised and consolidated, came into force as Alberta Regulation 467/67. As was expected because of the depth and extent of review leading to the new regulations, some amendments were necessary at an early date for the purposes of clarification, correction and the resolution of one or two points that could not be finalized before the new regulations became effective. These amendments were made by Alberta Regulations 120/68 and 126/68, each effective May 1.

Alberta Regulations 326/68 and 340/68, effective November 1, made further corrections and clarifications, amended the provision authorizing approval of two or more pools for unsegregated production to indicate that normally such approval would be on a pool-wide basis, modified the provisions of section 707 governing the use of low flash point hydrocarbons in well completions and section 709 governing blow-out prevention equipment, added a new section 902a requiring Board approval for the production of gas associated with oil sands and

contained a revision of two of the prescribed forms. Alberta Regulation 398/68, made concurrently with some amendments for the same purpose of certain regulations under The Mines and Minerals Act, 1962, amended section 104, governing the form of deposits required of well licensees, by restricting the government backed bonds that are acceptable as to rate of interest and length of balance of term.

V DUTIES, ORGANIZATION AND MAJOR ACTIVITIES OF BOARD DEPARTMENTS

This section of the report deals with the make-up and principal activities of the nine Board departments. The technical departments are described first.

Before outlining the individual departmental activities, it is probably worthwhile to mention the overall activity in the consideration of registered applications. During 1968 the Board received 546 applications of the type which it registers individually. This volume is slightly reduced from the 564 applications filed in 1967. Such applications are those which, if approved, would result in the issuance of a Board order, approval or permit. They are exclusive of routine applications such as those for drilling licences and well allowables which are processed on a day-to-day basis. Public hearings were held in connection with 87 of the applications, 37 of them by Board members and the balance by examiners selected from among the senior staff and appointed by the Board. Approximately 189 of the applications were considered after giving public notice for objections and the balance, having no impact on the rights of others, were dealt with directly by the Board and its staff.

Most of the Board departments are involved with the processing of applications from time to time. In fact, the functions related to applications form a large part of the

work load of the Board organization. Many of the applications require extensive technical analysis and subsequent reports to the Board. The review of the performance of approved schemes also demands considerable attention from the technical departments.

In addition to the foregoing, there are other general activities in which the Board and its staff participated. One of these is contributing to the work of technical and other specialist committees of various government and industry organizations. Among the organizations having Board representation in 1968 were the Alberta Advisory Committee on Pollution Control, the Provincial Mines Ministers' Conference, including the Interprovincial Petroleum and Natural Gas Committee and its study groups, the Interstate Oil Compact Commission committees, the Alberta Petroleum Industry Training Service, the Petroleum Technology Committee of the Southern Alberta Institute of Technology, the Gas Technology Committee of the Northern Alberta Institute of Technology, the NATO Wartime Oil Organization, the War Supplies Agency of the Department of Defence Production, the Emergency Measures Organization and the National Advisory Committee on Petroleum Statistics.

During 1968 the Board conducted an afternoon seminar for the graduating class of the Imperial Defence College of London, England and also for a group of foreign service officers of the Department of External Affairs, Ottawa.

The Board also commenced a training program for a Petroleum Technologist of the Government of Nigeria.

A DEVELOPMENT DEPARTMENT

The Development Department is responsible for matters within the Board's jurisdiction concerning the drilling, completing and producing of wells.

The Department is divided into three main sections: the Drilling Division under the Senior Drilling Engineer, the Production Division under the Senior Production Engineer, and the Area Offices and Chemical Laboratory supervised by the Senior Development Engineer, The responsibilities, functions and organization of each of these is described in more detail below.

(a) Drilling Division

This Division's main responsibilities are to ensure the proper location of wells, to reduce the possibility of subsurface contamination and blow-out hazard by specifying proper procedures for casing, cementing and abandoning wells and, through inspections by the field staff, to ensure that drilling operations are properly conducted.

The major functions of the Division are

(1) to process applications to drill, suspend, rework, plug back or abandon a well; to specify casing, cementing and completion practices; to calculate from directional

surveys penalty factors for off-target wells;

(2) to appraise and make recommendations to the Board regarding the disposition of applications for special drilling spacing units and compulsory pooling to form drilling spacing units;

(3) to maintain files and records respecting well names and changes thereto, unit agreement areas, well licences, well licence transfers, amendments and cancellations, and appointment of agents; and

(4) to review drilling and service rig inspection reports from the Board field staff, and correspond with contractors regarding the recommendations arising from the rig inspections.

The Division staff complement during 1968 was as follows: the Senior Drilling Engineer, one Drilling Engineer, two Engineering Assistants, two Stenographers and one Clerk.

Activities During the Year

New Conservation Regulations came into effect on January 1, 1968, changing target area, off-target penalty calculation and exemption, and well licencing regulations. The Board now issues well licences directly, rather than

through the Department of Mines and Minerals. The number of licences issued in 1968 increased substantially to 2,172 from 1,812 in 1967. Applications for special drilling spacing units increased sharply to provide for drilling of wells outside the normal target area to assist in the search for small Rainbow-Zama pinnacle reef pools, and also to obtain penalty relief for older wells that had been drilled outside normal target areas.

Regulations to prevent blow-out of drilling wells were improved during the year by specification of pressure bleed-off manifold equipment and design, and by the introduction of a blow-out control drill which rig crews will be asked to carry out during inspection by the Board's field staff.

One major blow-out occurred at a well in the Berland River area. The well blew sour gas for 11 days before it was brought under control by pumping mud down the drill pipe. Other less serious instances of loss of control occurred at two wells in the Zama area and at three wells at Wainwright, Frog Lake and Little Bow.

Two companies were prosecuted for violation of the Board's smoking regulations and two inquiries were held to determine the reasons and possible remedies for other apparent infractions of regulations.

(b) Production Division

The Production Division's major responsibility is to ensure accurate measurement of produced or injected reservoir

fluids, both on a pool-wide and individual well basis. The Division is also responsible for such matters related to production as reduction of physical waste and control of air, water or soil pollution, approval of new types of production equipment, disposal of produced water, approval and surveillance of multi-zone completions, and control of common flow lines.

The principal functions of the Division are

(1) to co-ordinate field staff inspections of measurement practices, well testing procedure and production accounting and to correspond with the operators regarding the results of these inspections; to perform periodic audits of company production accounting methods at their major offices;

(2) to deal with requests for exemption from gas or water measurement for wells or pools and requests for reduction of testing frequency.

(3) to appraise applications for water disposal schemes and recommend disposition of them, to review disposal methods for produced water and recommend volume restrictions for surface disposal where necessary; to review field reports regarding air, water and soil pollution and require operators to take the necessary steps to curb air pollution from

well production facilities; and

(4) to process applications for multi-zone completions and common flow lines and schedule and evaluate segregation tests on multiple completions.

The Division staff complement during 1968 was as follows: the Senior Production Engineer, one Production Engineer, two Engineering Assistants and a Stenographer.

Activities During the Year

A program for computer surveillance of water disposal to surface pits was completed which will help the Division reach its goal of limiting monthly surface disposal to 100 barrels per pit in all fields in the Province where it is practical to do so. About one-third of the fields in the Province are now restricted to a pit disposal limit of 100 barrels per month. A practical goal will be to limit about 75 per cent of all fields to the 100-barrel maximum.

One inquiry was held to investigate the improper disposal of salt water. Surface disposal was prohibited until the pit was properly reconstructed.

To improve the quality of fluid metering, the Division issued an interim directive which set out minimum specifications for the installation and operation of oil and water meters. This action was taken because field inspections showed very poor quality fluid metering, which could result in large errors

in individual well production data.

Air pollution complaints continued at a level slightly higher than last year. Investigations by the Board and the Department of Health usually disclosed malfunction of equipment as the main reason for odours where they occurred, although in a large percentage of cases, no evidence of odour emission could be found to support the complaint. General complaints of sick cattle or human illness ascribed to air pollution are difficult to resolve and occasionally the complainants refuse to accept the findings of investigators from the Board, Department of Health or Department of Agriculture. Arrangements were being made for closer co-operation among the many departments involved in the investigation of pollution complaints.

The number of multiple completions increased by 46 to 461 dual and three triple-zone completions. Three cases of commingling in the well bore were detected by segregation tests which are conducted annually to ensure that communication does not exist between the zones.

A new regulation to reduce the possibility of ground-water contamination requires an annual test on each water injection well to ensure that injected water cannot enter a shallow water zone if the well casing develops a leak. Of the 718 injection wells in the Province, 518 were tested during the year to reveal 48 unsatisfactory completions.

(c) Area Offices

The chief duties at the area offices are to ensure that The Oil and Gas Conservation Act, the regulations thereunder, and the various other requirements of the Board are observed by the industry at the field level. The area office personnel gather drilling and work-over data, check subsurface pressure data using Board equipment, and procure fluid samples for analysis by the Chemical Laboratory.

To carry out these responsibilities, there are a number of separate duties which together comprise most of the work load of the area offices.

The major duties are

(1) to advise operators on the requirements of the Act, Regulations and Board policy regarding field operations;

(2) to issue or approve abandonment and casing programs;

(3) to check wells, batteries, measurement equipment and drilling and service rigs for compliance with the Regulations; to witness dual completion operations, segregation tests, back pressure tests and casing and abandonment operations;

(4) to carry out subsurface pressure measurements, calibrate pressure instruments, and gather

representative samples of oil, gas and water for analysis;

(5) to check operators' production practices and reporting procedures and make reports on gas processing plants, salt water disposal systems, pressure maintenance projects and gas conservation schemes; and

(6) to prepare weekly drilling progress and rework reports.

Organization and Staff

Five Area Offices at Edmonton, Drayton Valley, Red Deer, Medicine Hat and Black Diamond are supervised by Area Engineers or Area Supervisors who report to the Senior Development Engineer in Calgary.

At the end of 1968, the total field staff complement consisted of three Engineers, 37 Technicians, two Clerks and six Stenographers, a reduction of three from the previous year-end.

Activities During the Year

Rainbow-Zama continued as the most active area in the Province, with 100 pools added during the year to bring the total number to about 300, most of which are the small pinnacle, one-well type. Increased frequency of rig inspections in the area throughout the year appears to have shown favorable results, since rig conditions were generally good and only two minor blows occurred, despite the high level of activity.

The Kaybob South, Strachan and Quirk Creek gas fields developed further during the year to provide major gas reserve additions.

The number of oil wells and batteries declined slightly during the year as a result of the formation of production spacing units and the consolidation of the remaining wells into larger batteries, a trend which started about two years ago. About 9,200 oil wells are currently producing to 1,200 batteries. Gas wells continued to increase steadily as gas production increased by about 13 per cent over last year.

The Board's field staff continued to place special emphasis in its field inspections on production data from gas pools and gas processing plants. Following a program started last year, the staff has checked the quality of water measurement in all major gas pools to ensure that water production is detected in its early stages, so that appropriate action can be taken to lessen its effect on gas recovery. In addition, detailed plant balances were commenced during the year on gas processing plants in an attempt to obtain accurate reports of well production and plant product volumes. As part of the Board's continuing check of oil and gas well production data, audits were made of selected production reports of about one-quarter of the producing wells in the Province.

(d) Chemical Laboratory

The staff of the Chemical Laboratory, located in

Edmonton, is responsible for the selection and analysis of samples of oil, gas and water which are representative of the fluid content of various designated pools in Alberta. In addition, it collects, assesses, classifies and files the results of gas and fluid analyses from well owners for samples from wells drilled outside of designated fields. From these data sources, representative analyses for most of the oil and gas productive zones of the Province are selected and published. The Laboratory also performs any analytical investigations related to production, disposal, or pressure maintenance problems encountered by the field staff. Certain facilities are made available to the University of Alberta, and the Chief Chemist provides a limited amount of assistance with research projects of both the University and the Research Council of Alberta.

The analytical and clerical work is performed by two Technicians and two Typists and is supervised by the Chief Chemist.

Activities During the Year

The number of analyses performed by the Laboratory declined sharply as a result of a change in the Conservation Regulations. Operators are now required to submit an analysis of any oil, gas or water sample taken from a well drilled outside of a field. Previously, the operator could submit either the samples or an analysis of the sample.

A project to standardize analytical methods and reporting of heavy oil samples was completed with a meeting of other laboratory representatives to review the problems and agree on common procedures. A major equipment renovation was undertaken to improve the accuracy of gas chromatograph analyses.

B OIL DEPARTMENT

Responsibilities and Functions

The Oil Department is concerned with matters affecting conservation and correlative rights in crude oil production operations. It is responsible for the assessment and surveillance of enhanced recovery operations, assessment of reserves and productive capacity of oil pools, oil well spacing, oil sands schemes, experimental schemes, and technical matters relating to the proration plan.

The principal functions of the Oil Department relate to reservoir engineering and are

(1) to determine initial and remaining oil reserves, reserves growth trends and maximum rate limitations of production;

(2) to review the performance of all oil pools and enhanced recovery schemes therein, and recommend to the Board means of improving conservation in pools where it is feasible;

(3) to assess applications for enhanced recovery schemes, pilot tests and commercial and

experimental oil sand schemes, and assess in co-operation with other departments applications concerning water disposal, concurrent production and production measurement;

(4) to assess applications respecting oil well drilling spacing units, production spacing units, blocks and projects and related matters;

(5) to co-ordinate measurements and maintain records of subsurface pressure surveys of oil pools in the Province; and

(6) to initiate Board orders for fields and pools; to establish minimum allowance allocations of production spacing units, blocks and projects; to advise the Board respecting ultimate reserves, recovery factor modifiers, and maximum rate limitations and to advise the Economics Department in the preparation of the monthly crude oil production allowable order.

Organization and Staff

The Oil Department staff includes 17 Engineers, 18 Technical-clerical Assistants, one Stenographer and one Typist. The engineering staff is divided into two main divisions. The Reserves Division is responsible for evaluation of oil reserves, recovery factor modifiers and maximum rate limitations and for assessment of applications respecting oil

well drilling spacing units, production spacing units, blocks and projects. The Projects Division is responsible for evaluation of proposed enhanced recovery schemes, surveillance of enhanced recovery operations in conventional crude oil pools, oil sands recovery schemes and experimental schemes. The clerical-technical group provides assistance to each engineering division, prepares basic technical data and performs routine Board administrative duties.

Activities During the Year

The development of new crude oil reserves continued to be centred in the Rainbow and Zama areas during 1968 where more than 250 pools have been developed. The pinnacle reef pools in these areas usually contain only one or two wells such that geological control for purposes of reserves evaluations is often very poor. Oil in place is established initially by arbitrarily assuming the area of the pool to be 160 acres. As soon as adequate production and pressure decline data is available, material balance calculations are performed to determine the oil in place. These calculations are reviewed with pool operators at monthly meetings. Approximately 150 pools were reviewed in this manner during 1968. The meetings take the form of informal hearings, and operators' submissions become official records. A few pools so reviewed were set over for formal hearing.

An interim directive (ID 68-3) was issued to provide for the obtaining of the initial pressure and subsequent

pressures every three months for the first year of production for pools in the Rainbow and Zama areas. Also the regulations were changed to require in each new oil pool throughout the Province determination of the initial pressure and an early follow-up pressure measurement. These requirements were introduced to meet the need for accurate pressure determinations for material balance and reservoir simulation evaluations. As a direct result of these provisions, the number of pressure surveys for the Province increased from about 4500 in 1967 to over 5800 in 1968, and the Department's bottom hole pressure section experienced a 25 per cent increase in work load. In addition, it participated in the preparation of material balance and reservoir limits evaluations.

About 25 new enhanced recovery schemes were considered by the Oil Department during 1968. The most noteworthy were two integrated schemes (I.S. No. 1 and I.S. No. 2) in the Rainbow Field which involved vertical displacement. These were made possible when section 36(3) was added to the Conservation Act to permit combined operation of several pools in a single enhanced recovery scheme. The integrated schemes in Rainbow will permit sequential solvent flooding of pools through optimum use of a limited available gas supply. The increase in reserves over existing depleting mechanisms resulting from I.S. No. 1 and I.S. No. 2 are 73.8 million stock tank barrels and 13.2 million stock tank barrels respectively, a total of some four million

barrels being attributable to the sequential aspects of the scheme. Waterflood schemes for two major pools, Mitsue Gilwood A and Nipisi Gilwood A, were considered during the year. The increase in recoverable reserves over primary recovery resulting from these schemes was 111 million stock tank barrels and 112 million stock tank barrels respectively. In the heavy crude oil pools, the Jenner Upper Mannville E Pool was placed on waterflood using a 20 per cent viscous slug designed to improve the mobility ratio. A review was made of the pressure and production performance of some 165 pools in the Rainbow and Zama areas. Where performance indicated the need, the initiation of pressure maintenance was pursued with the pool owners.

Arrangements for the final step in the transition to the new proration plan, which will be fully implemented in May, 1969, underwent extensive analysis and testing during 1968 with the Oil Department participating to a significant degree.

Developments in oil sands included a hearing of an application by Syncrude for approval of a commercial plant. The application was denied with a provision for reconsideration in 1969. The plant of Great Canadian Oil Sands was put on stream but had not achieved production at full design capacity by year end due to technical and start-up problems.

Section 38(e) was added to the Act to provide for Board authorization of schemes for concurrent production of

an oil zone and its associated gas cap. A large number of approvals were issued to cover operations previously authorized by letter. After public hearings, the Olds Wabamun A Pool was granted continued concurrent production and, in addition, was assigned the status of "good production practice" (GPP) with an oil production limit equivalent to 200 barrels per well per day. Concurrent production was approved for the Ferrier Cardium D and E Pools, although a request considered at the same time for GPP in the Cardium D Pool was denied. The Board granted GPP for some 80 pools in 1968, most of them small in size and about equally divided between light and medium and heavy gravity pools.

The new spacing regulations providing for a centralized target area came into force on January 1, 1968, supplanting, for oil wells, the previous standard target area located in the south-west legal subdivision in each quarter section. Appropriate buffer zones surrounding areas developed on the old target provisions were established initially by reference to pool boundaries. These are being supplanted by permanent spacing orders as special needs arise. Thirty such spacing orders were issued in 1968.

Advanced, significant or unique engineering applications involving Oil Department engineering staff during 1968 included studies of gravity over-ride in horizontal solvent floods, solvent bank design for vertical miscible floods, well

coning effects on recovery efficiency in vertical drive systems, three phase, one dimensional mathematical reservoir simulation, rock compressibility in carbonate reef pools, determination of reservoir limits using reservoir pressure data, and use of a layered material balance approach in high relief pools.

C GAS DEPARTMENT

Responsibilities and Functions

The Gas Department is concerned with the conservation of gas and related products, including propane, butanes, pentanes plus and sulphur. In addition, the Department is responsible for the determination of the reserves and deliverability of gas, natural gas liquids and sulphur, and for assessing the availability of gas to meet requirements of the various utility systems in the Province.

Specifically, the Department has the following functions

(1) in the administration of The Oil and Gas Conservation Act

(a) to establish permissible rates of production for gas wells, determine frequency of gas well tests and prescribe methods of testing wells and calculating flow potentials;

(b) to assess the need for gas cycling schemes to conserve natural gas liquids, and to assess the suitability of proposed schemes for depleting gas pools;

(c) to review the production performance of all gas pools;

(d) to carry out studies with regard to the establishment of gas conservation schemes;

(e) to assess the suitability of proposed gas processing facilities, to review the performance of installed gas processing facilities and to review regularly, at the request of the Public Utilities Board, the requirements for and availability of gas to small gas utility systems;

(f) to review, at the request of the Department of Mines and Minerals of the Provincial Government, applications to construct pipe lines and to advise the Department of the Board's findings;

(g) to review the performance of all schemes conserving gas produced unavoidably with oil;

(2) in the administration of The Gas Resources Preservation Act

(a) to calculate reserves in all pools in the Province of gas, propane, butanes, pentanes plus, condensate and sulphur; to assist the Board in assessing applications for removal from the Province of

gas and propane;

(b) to determine the deliverability of gas produced from fields connected, or expected to be connected, to intra-provincial and extraprovincial markets at such time that applications for removal of gas from the Province are considered by the Board; and

(c) to determine the availability of propane in the Province at such times as applications for removal of propane from the Province are considered by the Board.

Organization and Staff

The Department is primarily technical in nature, and is headed by the Manager. The Assistant Manager is responsible for the day-to-day operations of the Department. The Senior Reserves Engineer is responsible for the Reserves Section and oversees and co-ordinates the evaluation of gas reserves. The Senior Projects Engineer appraises proposals presented to the Board concerning the cycling of gas pools and the processing of raw gas to produce marketable gas and natural gas liquids and sulphur. He sees to the surveillance of existing gas utilities and the estimation of reserves of propane, butanes, pentanes plus and sulphur. The Conservation Engineer is responsible for the surveillance of existing gas processing plants and

conservation operations in oil and gas fields. He also directs studies of the feasibility of conserving gas and natural gas liquids. The total Department staff comprises six Engineers, six Technicians, a Stenographer and three Clerks.

Activities During the Year

The Department considered and reported upon applications for the removal of an additional 2.1 trillion cubic feet of gas and 162 million barrels of propane from the Province. The first application was granted for the full quantity of gas requested. The application for the removal of propane was granted but for a reduced volume of some 89 million barrels. At the year end a report on an application to remove a further 1.7 trillion cubic feet of gas from the Province was being prepared. In assessing these applications and in determining year end reserves the estimates of the reserves of some 500 pools were considered. A great deal of work was again devoted to the determination of the reserves of certain pools, where considerable production has occurred, on the basis of the pressure performance in relation to the total fluid withdrawals. In the assessment of applications for removal of additional gas from the Province consideration was also given to the deliverability of pools supplying local utilities and included in export permits.

A scheme for reprocessing gas removed from the Province through the foothills division of Alberta Gas Trunk Line was considered and approval granted. A similar scheme

has been in operation for several years at Empress on the plains division of the Alberta Gas Trunk Line system. The latest scheme will process some 780 million cubic feet of gas per day from which 6,600 barrels of propane, 3,100 barrels of butanes and 960 barrels of pentanes plus will be extracted daily.

The development of the large Kaybob South Beaverhill Lake Pool containing gas which is rich in natural gas liquids resulted in two applications for approval of cycling schemes to improve recovery of the natural gas liquids. The first application was granted but the second application was dismissed primarily because of insufficient data respecting the suitability of the cycling rate in relation to the performance of the pool and the impact of natural gas liquid production from the pool on the market for crude oil.

Studies were made of the economic feasibility of conserving gas produced in some twelve oil fields. In many instances these studies and subsequent consultations with the operators and well owners have resulted in the installation or extension of gas conservation schemes.

Applications were received for approval of twelve new gas processing schemes and of modifications to an equal number of existing schemes. Most of the modifications proposed were for increases in plant capacities, improvement in sulphur or natural gas liquid recovery facilities or installation of LPG recovery facilities where such facilities were

not included previously. In considering gas processing plant applications particular attention was given to the economic feasibility of conserving vapours from processing vessels and stock tanks as well as the feasibility of improving sulphur recovery.

Applications for approval to commingle production from several pools in seven fields were considered. Approval of commingled production is ordinarily granted only where segregated production is uneconomic or marginal in nature and commingling production will not adversely affect ultimate recovery and the rights of owners.

The staff also consulted with the Development and Oil Departments on numerous additional applications and studies. These included applications for concurrent production of gas and oil, gas oil ratio penalty relief, solvent and gas flooding, suspension of well spacing regulations in gas fields, special gas well spacing units and relief from normal gas measurement requirements.

D GEOLOGY DEPARTMENT

Responsibilities and Functions

The Geology Department is responsible for the preservation and evaluation of certain well data, the administration of the Board's well evaluation requirements, the mapping of oil and gas reservoirs and the preparation of subsurface geological maps. The Department also makes special studies related to

these responsibilities to assist other Board departments and the Alberta Department of Mines and Minerals. Additionally, the Board's Core Storage Center is administered by the Department and provides for the processing, storing and public examination of all core and important drill cuttings recovered from wells drilled in the Province. The Drafting Section of the Geology Department is responsible for the preparation of all maps, charts and graphs, and all general drafting for the Board organization.

The main functions of the Department are

(1) to administer the coring, logging, drill stem testing and drill cutting requirements of the Board and to collect and store logs and drill stem test charts;

(2) to receive, process and provide examination facilities for drill cuttings and core at the Core Storage Center;

(3) to evaluate hydrocarbon-bearing intervals at all productive wells and prepare maps to delineate the area and volume of each pool;

(4) to identify, record and publish the names and depths of the stratigraphic markers penetrated by all wells drilled;

(5) to investigate and report on the geological aspects of submissions or other evidence

filed with the Board;

(6) to advise the Board, other Board departments and the Department of Mines and Minerals on geological matters;

(7) to assist the Development Department in ensuring that a well drilled to supply an oil field water injection scheme does not interfere with domestic water supplies;

(8) to develop and maintain geological cross sections and geological well location, and status maps for sale and on-premise use;

(9) to classify each well licensed in accordance with the Lahee classification system; and

(10) to provide all drafting services necessary for the Board's functions.

Organization and Staff

The Manager of Geology is both head of the Geology Department and Chief Geologist of the Alberta Department of Mines and Minerals. Within the Geology Department there are three distinct sections. The Geology Section comprises the Manager, the Assistant Manager, ten Geologists, four Technicians, one Stenographer, two full-time Clerks and one part-time Clerk. The Core Storage Center is headed by a Supervisor responsible to the Manager of Geology and includes a staff of 14. The Drafting Section consists of five draftsmen, including the Senior Draftsman who reports to the Manager of Geology.

Activities During the Year

(1) Geology Section

During the year, stratigraphic markers were identified and published for over 1,900 wells and hydrocarbon-bearing zones were evaluated for some 950 wells.

A considerable amount of time was spent investigating applications and submissions received from operators on such matters as production spacing units, pressure maintenance schemes and off-target penalty relief.

Miscellaneous activities included the geological classification of wells, determining casing requirements and collecting stabilized pumping levels on water supply wells, investigating near-surface blowouts in areas where test hole applications were received, and approving logging and coring programs and abandonment applications.

A concentrated effort was made to use the computer on geological projects that lend themselves to mechanical processing. In this endeavour, data was retrieved for a regional mapping project with good success. Computer plotting and contouring techniques were also tested for this project, but only partial success was achieved. These techniques were, however, more successful when applied to a number of pool studies.

Geological work for the Department of Mines and Minerals consisted of evaluating parcels for Crown reserve

sales, processing P. & N. G. reservation reports for lease rental credit, preparing zone designations and providing technical advice on applications for gas leases.

(2) Core Storage Center

Public examination of core and drill cuttings continued at a high level. Approximately 24 geologists used the facilities each working day. A total of 102,000 boxes of core and 440,000 drill cutting samples were examined during the year.

Some 263,000 sets of drill cuttings were processed and 18,000 boxes of core were received into storage. To provide space for the incoming core, some 12,300 boxes of backlog core were re-packaged in the smaller cartons currently in use. This operation recovered space for about 7,400 boxes of incoming core.

Extensive mechanical modifications were made to the ventilation system to improve the ventilation and provide better control of dust and acid fumes. Other equipment was installed to improve the handling of unwashed samples and to facilitate the retrieval of the washed samples from the storage shelves.

(3) Drafting Section

During the past year, there was an increase in the numbers of base maps prepared for oil and gas field development and in the number of forms drafted for the Data Processing Department.

The decision to republish the oil and gas pool performance charts and the gas plant performance charts lead to

preparations for handling this increased work load.

E DATA PROCESSING DEPARTMENT

Responsibilities and Functions

The Data Processing Department is responsible for carrying out systems planning, program development, electronic machine operations, staff training related to data processing, and for surveying electronic data processing activities and new equipment development.

More specifically, the functions of the Department are

(1) to analyze existing and proposed manual and electronic systems with a view to designing and implementing new systems, improvements and innovations;

(2) to analyze and appraise proposed computer applications;

(3) to write engineering, accounting, statistical and economic computer programs as required in the work of the Board organization;

(4) to conduct effective closed-shop programming by educating department staff and maintaining an appropriate literature and program library;

(5) to encourage open-shop programming by educating appropriate staff from other departments and by assisting with open-shop programming assignments where necessary;

(6) to accurately process data received from other departments in order to obtain statistics for internal use or for publication;

(7) to perform computer calculations for geological and oil and gas engineering evaluations;

(8) to advise the Board on advances in the field of computer technology; and

(9) to familiarize supervisors and personnel throughout the organization with computer applications, data processing, and effective systems planning.

Organization and Staff

The Data Processing Department is divided under the Manager into two main divisions with two Supervisors, one of Programming and one of Operations. There is also a Systems Analyst who reports directly to the Manager. The remainder of the staff comprises seven Programmers, eight Computer or Keypunch Operators and a Stenographer.

The Programming Division is responsible for all computer systems and programs required by other departments in the Board organization while the Operations Division is responsible for all functions related to electronic machine processing. The Systems Analyst works closely with other departments and the Programming Division in the development of new manual and computer systems.

Activities During the Year

During 1968 the Programming Division was able to shift the emphasis of program development from accounting to technically oriented applications. Maintenance of existing systems and programs continues to grow and has become a major responsibility. At year-end approximately 350 operational computer programs supported some 35 systems and application areas.

The Programming Division completed and released the core analysis storage and retrieval system early in 1968. The system has experienced increasing usage throughout the year. The general well data system was released on an experimental basis at approximately mid-year. Several retrieval applications have been implemented and official release of this system is expected early in 1969. Maintenance and further editing of both the core analysis and general well data files continues to be a major responsibility for the Programming Division.

Additional major undertakings completed by this group during the year include the conversion of the market demand and allowables system to accommodate the Board's new proration plan and a system for the tabulation of historical production statistics on a pool basis. The Division also contributed programming assistance to the reservoir simulation group, initiated the calculation of reserves by computer, and completed several major technical applications such as a gas gravity correlation and a generalized material balance.

During 1968, the Operations Division was involved primarily with the encoding and processing of business and engineering data in accordance with regular schedules.

The 360/30 computer installation was upgraded late in the year through the addition of a disk drive and control unit. Computer usage was in the order of 2-1/2 shifts per day for the initial portion of the year. It then declined to slightly less than 2 shifts per day during the summer months and with the addition of the disk in October, has continued at about 2 shifts per day. Approximately one quarter of the computer time has been used for program development and the remainder for a variety of production runs. Some 14,000 individual jobs were processed through the computer centre during the year.

F ECONOMICS DEPARTMENT

Responsibilities and Functions

The Economics Department is responsible for economic analysis and evaluation, the compilation of statistics and forecasts and the preparation of the monthly proration order.

The main functions of the Economics Department are

(1) in co-operation with the Oil and Gas Departments, to forecast demand and supply for liquid hydrocarbons, sulphur and natural gas in the Province of Alberta;

(2) to prepare a five-year forecast of petroleum industry activity relative to the functions

of the Board to serve as a basis for the Board's annual five-year expenditure and revenue forecast;

(3) to carry out special studies relating to economic aspects of conservation and applications presented to the Board;

(4) in co-operation with the Oil Department, to carry out the monthly oil proration computations; and

(5) to compile statistical and other information covering all aspects of the oil and gas industry.

Organization and Staff

The staff complement at December 31, 1968, comprised the Department Manager, an Assistant Economist, an Economics Assistant, a Statistical Clerk and a Stenographer. An Engineer was also attached to the Department for part of the year.

Activities During the Year

The Department's regular activities were supplemented by a number of special projects. Of major importance was work in relation to the application of Atlantic Richfield Company, Cities Service Athabasca, Inc., Imperial Oil Limited and Royalite Oil Company, Limited for approval to produce some 80,000 barrels per day of liquid products from the Athabasca oil sands. Appraisal of the application involved an assessment

of evidence concerning the United States oil supply-demand balance and the significance of the United States oil import policy, in addition to examination of the detailed marketing plans of the companies involved. In connection with this application and for other purposes, forecasts of demand for Alberta oil were reviewed.

In the summer the Department undertook a new detailed forecast of Alberta population. A computer model was constructed to assist in the preparation of the forecast and in analyzing trends in migration. This forecast provides a basis for future estimates of provincial requirements, particularly in relation to natural gas and propane.

In connection with applications by Trans-Canada Pipe Lines Limited and Dome Petroleum Limited to remove natural gas and propane respectively from the Province, the Department reviewed and updated the Board's previous forecasts of Alberta's long term natural gas and propane requirements.

The Department was closely involved with work relating to the implementation of the May 1968 changes in the transition to the new proration plan.

G ACCOUNTING DEPARTMENT

The Accounting Department's responsibilities are carried out under two separate divisions, financial accounting and production accounting. The Manager of Accounting is the head of the Department and reports to the Board.

Financial Accounting Division

Responsibilities and Functions

The Financial Accounting Division is responsible for all general accounting and budget preparation. It assists in the collection of the Board's annual tax levy and provides the Board with all information for budget control.

The major functions of the Division are

(1) to process all expenditures, receive all revenues and maintain all necessary records;

(2) to close the accounting records as at March 31 each year and co-operate with a representative of the Provincial Auditor in his annual audit;

(3) to prepare, in co-operation with the other departments, the budget for Board approval for the next fiscal year and prepare a five-year forecast of expenditure and revenue;

(4) to provide the Board with monthly statements comparing budgeted and actual expenditure and revenue, to assist in the maintenance of control over expenditure, and to establish current financial policy;

(5) to assist, in co-operation with the Assistant Assessor, in the collection and follow-up of outstanding tax accounts;

(6) to maintain records necessary to the control of all inventorial assets of the Board and to supervise the annual physical check of inventory items.

Organization and Staff

The Financial Accountant is the head of the Division and is responsible to the Manager of Accounting. The staff complement at December 31, 1968, included the Financial Accountant, four Accounting Clerks, one Typist and a Bookkeeping Machine Operator. The complement of Clerks was reduced by one during the year.

Activities During the Year

During 1968, the general accounting functions embracing revenues, expenditures and budget were routine.

Production Accounting Division

Responsibilities and Functions

The Production Accounting Division is responsible for the receipt and processing of oil and gas production and disposition reports, and the preparation of detailed and summary information for use by the Board, industry and other agencies. The Assessment Section also is a part of the Production Accounting Division.

The major functions of the Division are

(1) to collect from industry the well production data and well and plant disposition data required

under The Oil and Gas Conservation Act;

(2) to ensure that the reporting forms in use provide for the collection of required information and are revised to meet changing needs; and to co-operate with other provincial and federal agencies in the use of comparable forms, and in the avoidance of duplicate collections of original data, where possible;

(3) to examine the reports received to ensure that regulatory requirements are met by the operators and, with the assistance of the Data Processing Department, to prepare detailed and summary records;

(4) to check the reported oil, gas and water production against assigned allowables and notify operators of the over or under status for each of their wells;

(5) to maintain records of production spacing units, blocks, projects, and single wells in connection with the new proration plan, showing minimum allowances and assigned acreages, and to make such records available to the Economics Department for the preparation of the monthly proration order;

(6) to ensure that the monthly and annual statistical reports and well and pool production publications are kept up to date and processed on schedule; and

(7) to prepare the assessment roll, to issue assessment notices, process appeals, issue tax notices and assist in the collection of the tax levy.

Organization and Staff

The Production Accountant and Assessor is the head of the Division and is responsible to the Manager of Accounting. He is assisted by the Assistant Assessor, the Statistics and Publications Supervisor, the Production Records Supervisor, 19 Clerks, a Typist and a Stenographer.

Activities During the Year

During 1968, many of the problems carried over from 1967, arising from the changeover to the IBM 360/30 computer equipment were solved. The allowable records were made current by mid-year and those changes in the proration system which affected the allowables surveillance were carried out with a minimum of trouble. A time-consuming comparison of well and pool production and injection records was completed in 1968, in order to bring these two separate sets of records into balance. The Well Data File, the MD File, the Allowables File and the Production File were also compared and corrections and adjustments

made where necessary. Arrangements were made for periodic comparison of these files to keep the subject matter common to all identical.

The new procedures used in the Report Processing Section since 1967, along with increased demands on computer time had resulted in a somewhat longer monthly processing schedule. Production data used in Board and Federal Government publications were being made available at a very late date. Some progress was made during 1968 in reducing the processing time, and this information is now available by the end of the first week of the month following the receipt of reports from industry.

Documentation of the various systems used within the Department was well under way in 1968, with the Assessment and Allowables systems all but completed, and a good start made on the Production and Injection Manual.

In the Statistics section, much time has been spent in the improvement in the accounting for movement of sulphur, propane and butanes. In this, the section has been assisted greatly by industry representatives and associations. This section also assumed the responsibility in co-operation with the Drafting Department for the preparation and publication of gas plant charts and pool performance charts.

H OFFICE SERVICES DEPARTMENT

Responsibilities and Functions

The Department is responsible for purchasing, printing and mailing, control of well records and central filing,

building requirements and services, and switchboard and reception duties.

The major functions are as follows:

(1) to attend to space, service and insurance requirements of all Board buildings;

(2) to maintain a purchasing and stock control program;

(3) to observe and control motor vehicle operating costs;

(4) to print or arrange for commercial printing of letters, orders, forms, reports, publications, maps, amendments to Acts, regulations and the Index to Board Orders; to maintain address plates for subscription lists, mail lists, and for various record-opening forms for new wells;

(5) to attend to all mailing functions and to operate all file systems other than department; to serve public requests for information from filed documents;

(6) to provide library services and transcriptions of public hearings; and

(7) to maintain drilling records for all wells drilled;

Organization and Staff

The Department is headed by the Office Services Supervisor who reports to the Board. There are three sections in the Department: Purchasing, Reproduction and Records, each headed by a Supervisor. The staff complement includes 20 Clerks, six Machine Operators and six Receptionists, Switchboard Operators, Typists and Stenographers.

Activities During the Year

A new subsection was established in the Records Section for processing and coding basic well data for computer applications. There was no significant change in the level of activity in the other sections of the Department.

I PERSONNEL DEPARTMENT

Responsibilities and Functions

The Personnel Department is responsible for attracting and maintaining competent staff to conduct the Board's business, and also for ensuring that the Board's policies relating to personnel are carried out.

The principal functions are

(1) to recruit new staff in co-operation with other departments;

(2) to administer programs of employee evaluation, staff education and employee benefits;

(3) to administer the Board's salary policy and conduct annual salary surveys; and

(4) to prepare, with the assistance of the other departments, the annual salary budget for the next year and record variances during the current year.

Organization and Staff

The Department is headed by the Manager, who reports to the Board. He is assisted by a Personnel Assistant, one Stenographer and one Typist.

Activities During the Year

The Department carried out its annual survey of salaries paid by industry and by the Provincial and Federal Governments to assist the Board in its annual salary review. Other surveys in which the Board participated were analyzed in order to ensure that the Board's salaries and other benefits were competitive. These surveys included such items as sick leave and expense accounts.

The Performance Appraisal Program was altered to place a greater emphasis on the achievement by senior and supervisory personnel of certain individual objectives.

The program to achieve and maintain a high degree of technical and supervisory proficiency was continued by conducting several on-premises courses, as well as by encouraging continued formal education.

During 1968, increased use of the Board's computer system was made in the maintenance of personnel records and reports.

VI EXPENDITURE AND REVENUE

The Board's fiscal year end is March 31, but, since all other sections of this report relate to the calendar year, the Board has decided to ignore the three month difference and treat expected expenditures and revenues relating to the fiscal year April 1, 1968 to March 31, 1969, as applying to the 1968 calendar year. Financial data for previous fiscal years are applied to the calendar year in a similar manner.

Table 1 provides a summary and comparison of expenditures and revenues for the years 1964 to 1968 inclusive. The Board's net expenditure represents the sum of salary, general operating, and capital expenditures less collections from the sale of publications and information. The cost of capital acquisition is charged in full against revenue in the year of purchase. Revenue of the Board is received through the levy of a tax upon the assessed value of all oil and gas properties liable to assessment and by a grant from the Provincial Government.

During the last five years, the Board's net expenditure has increased at an average annual rate of 7.6 per cent. Net expenditure during 1968 was $2,486,000, an increase of $128,000, or 5.4 per cent over the previous year. Salary expenditures increased by $137,000 or by 7.1 per cent to $2,090,000 which was below the five year average of 8.1 per cent. Other general operating expenses increased by $42,000 or by 7.1 per cent to $630,000 while capital expenditure

increased by $12,000 to $63,000. Collections increased by $63,000 to $297,000, due mainly to the fact that drilling license fees are no longer shared with the Department of Mines and Minerals.

Table 2 gives a comparison of Board expenditures in terms of wells capable of production, industry production revenue, and equivalent barrels of production*. Industry production revenue represents the total sales value of crude oil, natural gas and products at the well or plant. In 1968 the value of crude oil sales represented 70 per cent of the total production revenue as compared to 73 per cent in 1967.

The cost of operating the Board in terms of a capable well increased from $134 in 1967 to $136 in 1968. A review of these costs over a longer period indicates that Board expenditure per capable well increased steadily until 1957, when it reached $136, and then declined to $115 in 1965. Recent significant increases in salary costs, and the reduced rate of increase in the number of capable wells, due to the introduction of a new proration plan in May, 1965, have reversed that trend. Board expenditures per equivalent barrel of production revenue decreased from 0.68 cents to 0.61 cents over the period 1964 to 1968. Efficient utilization of electronic data processing equipment, and substantial increases in growth rate of industry revenue were largely responsible for this reduction in unit costs.

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* Equivalent Barrels = total industry production revenue divided by weighted average price per barrel of oil

For 1968, as in previous years, the Provincial Government will provide the funds necessary to meet approximately 47.7 per cent of the Board's net expenditure. This amounts to some $1,196,000 and represents a direct grant from the Provincial Government of $994,000 to meet 40 per cent of the net expenditure and an additional $191,000, being the Government's share of the Board's tax levy. The remainder of the tax levy charged to all other owners of oil and gas properties assessed amounted to $1,301,000 in 1968, an increase of $64,000 over the previous year.

The assessed value of oil and gas properties subject to assessment in 1967 was $2,155,000,000 resulting in a mill rate of 0.73 mills to raise the portion of Board revenue met by taxation.

TABLE 1

OIL AND GAS CONSERVATION BOARD
COMPARATIVE STATEMENT OF EXPENDITURE AND REVENUE
FOR THE FIVE YEARS 1964 - 1968
(000's Dollars)

	1964	1965	1966	1967	1968
Expenditure					
Salaries	$1,446	$1,543	$1,778	$1,953	$2,090
General Operating					
Building rent, utilities	181	182	186	193	217
Printing, office supplies	87	83	89	88	84
Travelling, automobile	62	61	67	64	68
Machine rental and repairs	58	59	79	119	125
Telephone	19	22	22	27	30
Lab. and Field supplies	19	20	16	22	20
Miscellaneous	55	69	75	75	86
	481	496	534	588	630
Capital	45	44	46	51	63
Total	$1,972	$2,083	$2,358	$2,592	$2,783
Collections	222	207	237	234	297
Net Expenditure	$1,750	$1,876	$2,121	$2,358	$2,486
Revenue					
Industry Share of Tax*	$ 924	$ 992	$1,114	$1,237	$1,301
Provincial Government Share of Tax*	126	134	158	178	191
Appropriation	700	750	849	943	994
Total Revenue	$1,750	$1,876	$2,121	$2,358	$2,486
Percentage Increase in Net Expenditure over Previous Year	1.8	5.4	13.0	11.1	5.4

* Actual Tax Levy Adjusted for Surplus

TABLE 2

OIL AND GAS CONSERVATION BOARD

Comparison of Board Net Expenditure

Per Capable Well and Industry Production Revenue

	Total Capable Wells	Staff Complement at December 31	Industry Production Value (000)	*Annual Production Equivalent Barrels (000)	No. of Capable Wells Per Staff Member	Board Net Expenditure Per Capable Well (Dollars)	Board Net Expenditure Per Equivalent Barrel (Cents)
1964	15,295	246	652,368	254,825	62	115	.68
1965	16,299	259	704,267	274,786	63	115	.68
1966	16,980	264	791,913	307,948	64	125	.69
1967	17,586	265	912,443	361,191	66	134	.66
1968	18,312	271	1,054,776	409,905	68	136	.61

$$* \text{ Equivalent Barrels} = \frac{\text{Total industry production value}}{\text{Weighted average price per barrel of oil}}$$

VII PUBLICATIONS AND ADDRESSES

The Board makes available to industry and the general public a wide variety of publications and maps. The pricing policy is based on the principle that those costs associated with a publication which are over and above normal operating costs must be met by revenue generated from its sale.

The publication of this report - Report of the Operations of the Oil and Gas Conservation Board - for general distribution has been resumed in 1968.

The following special reports resulted from major public hearings:

OGCB 68-A Report on an Application of Trans-Canada Pipe Lines Limited under The Gas Resources Preservation Act, 1956.

OGCB 68-B Report on the Application for a Permit Authorizing the Removal of Propane from the Province of Dome Petroleum Limited and Pan American Canada Oil Company, Ltd. under The Gas Resources Preservation Act, 1956.

OGCB 68-C Report of an Application of Atlantic Richfield Company, Cities Service Athabasca, Inc., Imperial Oil Limited and Royalite Oil Company, Limited under Part VIA of The Oil and Gas Conservation Act.

New Publications or Services Made Available in 1968

Oil Proration Data for all Prorated Oil Pools

This monthly subscription provides information for each non-confidential prorated crude oil pool. The information covers such matters as reserves, production, performance factor and other related items. Certain provincial totals are also included.

Computer Services

During 1968 the Board made available for sale certain data on magnetic tape files and special computer programs concerning core analyses data and production and injection file data. The information was made available at one price for information to-date and a further charge for an up-dating service.

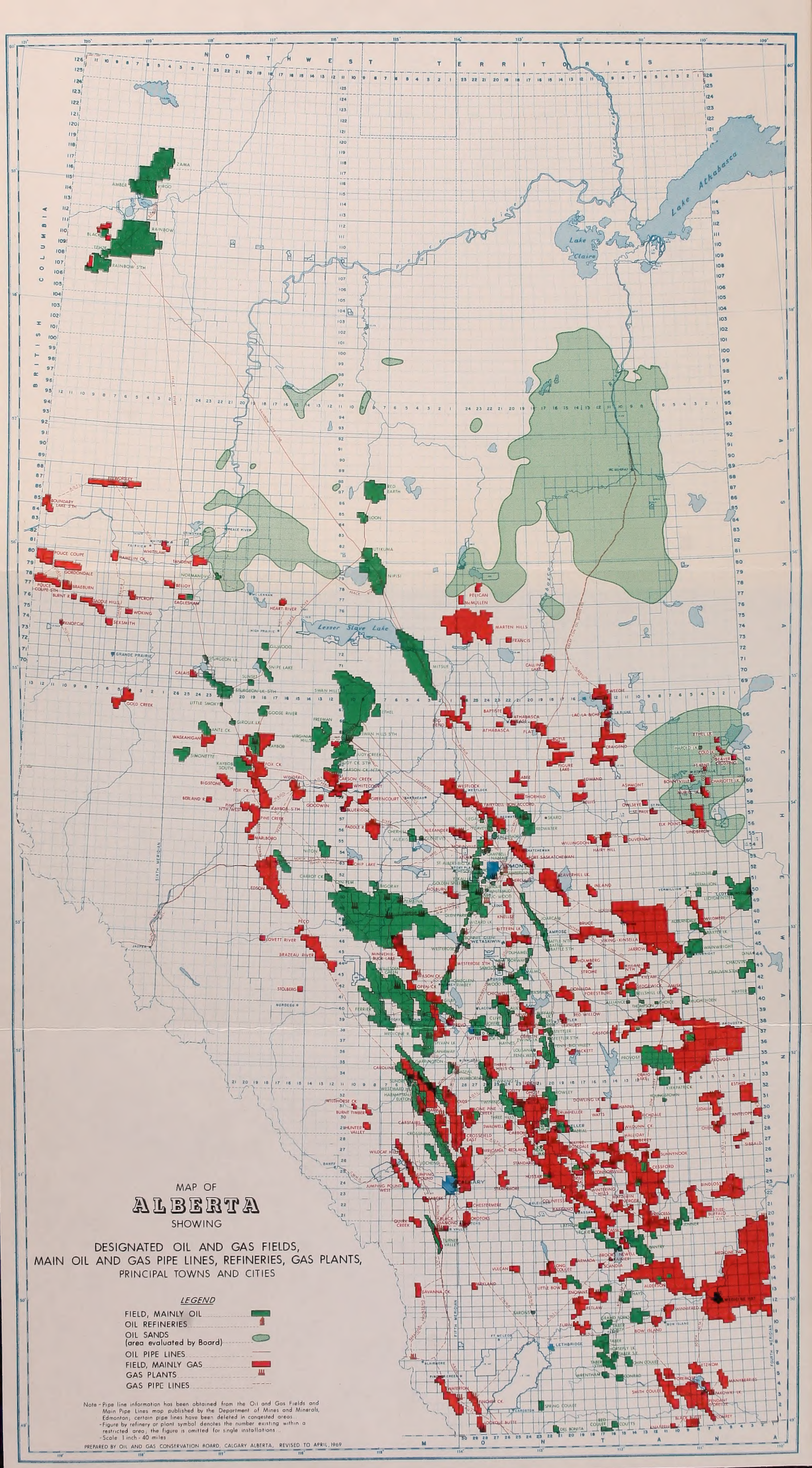
The following addresses, lectures or technical papers were presented by members of the Board and its staff in 1968:

Speaker	Title of Address
G. W. Govier	"Oil and Gas Conservation in Alberta" Society of Petroleum Technologists, Calgary, March 29, 1968
G. W. Govier	"The Importance of the Canadian Well Logging Society" Canadian Well Logging Society, Calgary, May 6, 1968
G. W. Govier	"Oil and Gas Conservation and its Relation to Pollution Resulting from the Petroleum Producing Industry" EIC "Banff Conference on Pollution", Banff, May 16, 1968
G. W. Govier	"The Administration of The Oil and Gas Conservation Act in Alberta" Canadian Petroleum Law Foundation, Jasper, May 30, 1968
G. W. Govier	"Regulations of Oil Production in Alberta" Association of Petroleum Landmen Convention, Fort Worth, Texas, June 14, 1968
G. W. Govier	"A Perspective of Western Canada's Oil and Gas Industry" Canadian Research Management Association - Sixth Annual Conference, Edmonton, October 9, 1968

Speaker	Title of Address
Vernon Millard	"An Assessment of the Growing Requirements for Canadian Gas and Propane" Propane Gas Association of Canada, Calgary April 5, 1968
K. W. Fuller	"Changes in Regulations on the Oil and Gas Conservation Board" Petroleum Production Accountants Association, Calgary March, 1968
K. W. Fuller	"Lectures for the Petroleum Production Accountants Course" Southern Alberta Institute of Technology, Calgary October-November, 1968
G. C. Watkins	"Markets for Alberta Oil and Gas Production" Desk & Derrick Club, September 17, 1968
R. G. Evans	"Lecture on Proration Plan" Petroleum Industry Training Service Unitization School, Banff November, 1968
D. G. Pearson	"A Simplified Approach for Assessing Gravity - Viscous Effects in Horizontal Steady State Solvent Floods" 19th Annual Technical Meeting of the Petroleum Society of CIM May, 1968
L. A. Bellows	"Conservation of Petroleum Resources" National Indian Affairs Minerals Conference May 27, 1968
L. A. Bellows	"Functions and Responsibilities of the Oil and Gas Conservation Board in Preventing Water Pollution" Fish & Wildlife Division of the Department of Lands and Forests December 19, 1968
R. H. Northam	"Gas Measurement Calculations" Canadian Association of Petroleum Production Accounting - Gas, Production and Accounting, September 19 and 26, October 3 and December 3, 1968

Speaker	Title of Address
P. D. Larbalestier	"Drilling Regulations of the Conservation Board" Imperial Oil Limited - Drilling Foremen April, 1968
P. D. Larbalestier	"Blow-out Prevention Regulations of the Conservation Board" Edmonton Section of O.T.S. November, 1968
W. Olson	"Origin and Organization of the Board" Desk & Derrick Club - Edmonton February, 1968
A. Casey	"Board Organization" PITS Lease Operator's Course October, 1968
R. Knopp	"Gas Measurement" PITS Lease Operator's Course October, 1968
B. McFarlane	"Search for Oil" Grades 7 to 10, inclusive, Ralston School May, 1968

Author	Title of Technical Paper
G. C. Watkins	"Trends in Alberta Oil Allowables" Oilweek April 22, 1968
G. C. Watkins and J. S. Rimell	"Conservation Board uses Exponential Smoothing for Propane Forecasts" Canadian Petroleum December, 1968


MAP OF
ALBERTA
SHOWING
DESIGNATED OIL AND GAS FIELDS,
MAIN OIL AND GAS PIPE LINES, REFINERIES, GAS PLANTS,
PRINCIPAL TOWNS AND CITIES
LEGEND
FIELD, MAINLY OIL
OIL REFINERIES
OIL SANDS
(area evaluated by Board)
OIL PIPE LINES
FIELD, MAINLY GAS
GAS PLANTS
GAS PIPE LINES
Note - Pipe line information has been obtained from the Oil and Gas Fields and Main Pipe Lines map published by the Department of Mines and Minerals, Edmonton; certain pipe lines have been deleted in congested areas.
- Figure by refinery or plant symbol denotes the number existing within a restricted area; the figure is omitted for single installations.
- Scale 1 inch - 40 miles
PREPARED BY OIL AND GAS CONSERVATION BOARD, CALGARY ALBERTA, REVISED TO APRIL, 1969
NORTHWEST TERRITORIES
BRITISH COLUMBIA
SASKATCHEWAN
MONTANA
Lake Athabasca
Lake Claire
Lesser Slave Lake
ZAMA
AMBER
VIRGO
RAINBOW
RAINBOW S'TH
BLACK
TENS
HYTHE
BOUNDARY LAKE S'TH
FAIRVIEW
WHITELAW
HAMELIN CK.
TANGENT
NORMANDVILLE
BELLOY
EAGLESHAM
HEART RIVER
WOKING
SEXSMITH
KNOPCIK
GRANDE PRAIRIE
GILWOOD
SNIPE LAKE
SUNSET
CALAIS
GOLD CREEK
LITTLE SMOKY
GOOSE RIVER
GIROUX LK.
WASKAHIGAN
SIMONETTE
KAYBOB
KAYBOB SOUTH
FOX CK.
WINDFALL
BIGSTONE
BERLAND R.
PINE NTH. WEST
KAYBOB S'TH
GOODWIN
PINE CREEK
MARLBORO
EDSON
PECO
LOVETT RIVER
BRAZEAU RIVER
STOLBERG
NORDEGG
MEDICINE R.
CARROT CK.
WILDHORSE CK.
BURNT TIMBER
HUNTER VALLEY
CARSTAIRS
WILDCAT HILLS
JUMPING POUND WEST
CALGARY
QUIRK CREEK
TURNER VALLEY
BLACK DIAMOND
OKOTOKS
CHESTERMERE
HIGH RIVER
VULCAN
SAVANNA CK.
MARYLAND
LITTLE BOW
ENCHANT
TABER
TABER S.E.
TABER S'TH
LETHBRIDGE
FT. MCLEOD
BLAIRMORE
PINCHER CREEK
WATERTON
WRENTHAM
CONRAD
SMITH COULEE
JOHN COULEE
LITZENBERG
MANYBERRIES
DEMONSTRATION
LAKEVIEW LK.
PENDANT D'OREILLE
COMFREY
BLACK BUTTE
DEL BONITA
COUTTS
SPRING COULEE
MILK RIVER
WARNER
RETLAW
BARONS
TURIN
CHIN COULEE
BOW ISLAND
MEDICINE HAT
ALDERSON
SCANDIA
BROOKS
NEWELL
BASSANO
STRATHMORE
GLEICHEN
CROSSFIELD
CROSSFIELD EAST
SWALWELL
CARBON
BEISEKER
WAYNE-ROSEDALE
DRUMHELLER
MORRIN
HANNA
WATTS
HALKIRK
HALKIRK CK.
HALLIDAY
SUNNYNOOK
CESSFORD
BINDLOSS
ANTELOPE
SEDALIA
ESTHER
KIRKPATRICK
YOUNGSTOWN
PROVOST
CASTOR
ORMO
LAKE
CHAUVIN
CHAUVIN S'TH
HAYTER
HUGHENDEN
ALLIANCE
THOMPSON
CHOICE
DONALDA
FORESTBURG
BELLSHILL LK.
KITSCOTY
EDGERTON
AMISK
VIKING-KINSELLA
JARROW
STROME
HOLMBERG
WAINWRIGHT
VERMILION
LLOYDMINSTER
WILDMERE
ALBURN
HAZELDENE
INLAND
BEAVERHILL LK.
DUVERNAY
HAIRY HILL
WILLINGDON
ELK POINT
LINDBERGH
ONOWAY
ST. PAUL
BONNYVILLE
CHARLOTTE LK.
MURIEL LK.
ETHEL LK.
COLOCK
HAROLD LK.
CRAIGEND
FIGURE LAKE
EDWARD
ASHMONT
BOYLE
LAC LA BICHE
TWEEDIE
ATHABASCA
BAPTISTE
MARTEN HILLS
FRANCIS
PELICAN
McMULLEN
CALLING LAKE
MITSUE
SWAN HILLS
SWAN HILLS S'TH
JUDY CREEK
CARSON CK. NTH.
CARSON CK. S'TH.
CARSON CREEK
WHITECOURT
GREENCOURT
BARRHEAD
WESTLOCK
THORHILD
FAIRVIEW
DEBOLT
LEGAL
SKARO
REDWATER
ALEXANDER
GIROUXVILLE
ALBERTA
MORINVILLE
LAMOUREUX
ST. ALBERT
EDMONTON
FORT SASKATCHEWAN
CAMPBELL
NAMAO
CHIP LAKE
NISTON
NORTH ISLAND
ISLAND MOUNTAIN
HOLBURN
GOLDEN SPIKE
WOLF LAKE
CHERHILL
PADDLE R.
PEERLESS
GRAY
SUNDRE
WESTWARD HO
HARMATTAN
ELKTON
CROSSFIELD
BRIGANTA
REDLAND
STANDARD
HUSSAR
CROSSFORD
CARSELAND
CAROLINE
SIBBALD
PRINCESS
ATLEE BUFFALO
MEDICINE LAKE
BRANT
RETREAT
ALDERSON
WINNIFRED
BOW ISLAND
SUFFIELD
ENCHANT
BROOKS
NEWELL
BASSANO
SCANDIA
VULCAN
CONG COULEE
LITTLE BOW
BARONS
TURIN
RETLAW
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BLACK BUTTE
DEL BONITA
COUTTS
SPRING COULEE
MILK RIVER
WARNER
FIFTH MERIDIAN
SIXTH MERIDIAN
FOURTH MERIDIAN
MOUNTAIN

JAN 4 1974